

June 17, 2011

ARB Staff Summary:**Archer Daniels Midland Columbus, Nebraska Corn Ethanol Dry Mill LCFS
Pathway 2B Application**Plant Summary

The Archer Daniels Midland Company's (ADM) Columbus dry corn mill ethanol plant is located in Columbus, Nebraska. The plant is permitted to produce more than 800,000 gallons per day of denatured ethanol. The plant has the capability of producing both dry and wet DGS. Design for the facility is based on an annual average moisture content of about 27 percent. The plant uses electricity produced at an adjacent combined-heat-and-power plant, and consequently uses no grid electricity during normal operations. This reduces the total energy use at the plant. The use of a dryer heat recovery system and Mechanical Vapor Recompression (MVR) evaporator further reduces energy use at the plant. ADM has specified two plant energy values for which it is seeking a sub-pathway approval. One plant energy value represents the baseline energy use of the plant, while the other, lower, value is intended to represent the energy use of the plant when additional heat recovery and energy savings are achieved in the future due to a more optimized mode of operation. The fuels used at the plant are various combinations of coal, natural gas, and biomass. ADM has specified two sets of four different combinations of coal, natural gas, and biomass fuel use. One of the sets of four combinations would be used with the baseline plant energy value, while the other set of four combinations would be used with the expected energy value for the plant when it is operating in the optimized mode. Thus, ADM is requesting ARB approval for eight sub-pathways, each with a different combination of plant energy values and fuel mix. The eight sub-pathways are shown in Table 1.

Table 1: Fuel Mixes under Baseline and Optimized Conditions

	Baseline Plant Fuel Mix (%)			Optimized Plant Fuel Mix (%)		
	Natural Gas	Coal	Biomass	Natural Gas	Coal	Biomass
Comb. 1	29.00	71.00	0.00	29.48	70.52	0.00
Comb. 2	29.00	65.15	5.85	29.48	64.35	6.17
Comb. 3	29.00	59.29	11.71	29.48	58.19	12.33
Comb. 4	29.00	53.44	17.56	29.48	52.02	18.50

Carbon Intensity of Ethanol Produced

Table 2, below summarizes the carbon intensities, as calculated by ADM, of the eight sub-pathways of the application. Also shown in the table are the conditions

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under which the carbon intensity values would be applicable for ethanol sold under the LCFS.

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Table 2: ADM Pathway Summary and “Not-To-Exceed” Conditions

Sub-pathway (% biomass)	Direct Carbon Intensity (gCO ₂ e/MJ)	Conditions for Applicability of Carbon Intensity Value ¹
<i>Baseline Plant Energy</i>		
0	90.99	1) Plant energy use not to exceed a value the applicant classifies as confidential; 2) No grid electricity use; 3) Coal use not to exceed 71.00% of fuel use (by energy); 4) Coal carbon content not to exceed 48%.
5	89.08	1) Plant energy use not to exceed a value the applicant classifies as confidential; 2) No grid electricity use; 3) Biomass ² must be at least 5.85% of the fuel use (by energy); 4) Coal use not to exceed 65.15% of fuel use (by energy); 5) Coal carbon content not to exceed 48%.
10	87.16	1) Plant energy use not to exceed a value the applicant classifies as confidential; 2) No grid electricity use; 3) Biomass ² must be at least 11.71% of the fuel use (by energy); 4) Coal use not to exceed 59.29% of fuel use (by energy); 5) Coal carbon content not to exceed 48%.
15	85.24	1) Plant energy use not to exceed a value the applicant classifies as confidential; 2) No grid electricity use; 3) Biomass ² must be at least 17.56% of the fuel use (by energy); 4) Coal use not to exceed 53.44% of fuel use (by energy); 5) Coal carbon content not to exceed 48%.
<i>Optimized Plant Energy</i>		
0	89.80	1) Plant energy use not to exceed a value the applicant classifies as confidential; 2) No grid electricity use; 3) Coal use not to exceed 70.52% of fuel use (by energy); 4) Coal carbon content not to exceed 48%.
5	87.86	1) Plant energy use not to exceed a value the applicant classifies as confidential; 2) No grid electricity use; 3) Biomass ² must be at least 6.17% of the fuel use (by energy); 4) Coal use not to exceed 64.35% of fuel use (by energy); 5) Coal carbon content not to exceed 48%.
10	85.91	1) Plant energy use not to exceed a value the applicant classifies as confidential; 2) No grid electricity use; 3) Biomass ² must be at least 12.33% of the fuel use (by energy); 4) Coal use not to exceed 58.19% of fuel use (by energy); 5) Coal carbon content not to exceed 48%.
15	83.96	1) Plant energy use not to exceed a value the applicant classifies as confidential; 2) No grid electricity use; 3) Biomass ² must be at least 18.50% of the fuel use (by energy); 4) Coal use not to exceed 52.02% of fuel use (by energy); 5) Coal carbon content not to exceed 48%.

¹Compliance with the “not-to-exceed” values will be based on monthly, quarterly, or annual average values, as determined by operational conditions. Calculation of the average values can exclude periods of abnormal operations, such as planned maintenance or *force majeure* events, and the facility may use grid electricity during such periods.

²Biomass fuels consist of waste seed and other agricultural waste

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The ADM Columbus Plant achieves lower carbon intensity values relative to the reference pathway through three principal means: First, through the use of dryer heat-recovery and mechanical vapor-recompression evaporation, plant energy values are reduced for the baseline and optimized plant operations. Second, the use of cogeneration eliminates the need for grid power during normal operations. Electrical energy is supplied by the cogeneration facility. Third, the use of biomass reduces carbon intensities by about 2 gCO₂e/MJ for each five percent increment of biomass co-fired in the cogeneration plant. The amount of coal used in the plant ranges from about 52 percent to 71 percent. If all else is equal, moving from 52 percent to 71 percent coal when the only other process fuel is natural gas would raise carbon intensities by about 3 gCO₂e/MJ. However, in the case of the Columbus plant, this carbon intensity increase is offset by the use of low-carbon-content coal. The carbon content of the coal used in the plant is about 48 percent compared to about 64 percent for the reference corn ethanol pathway.

Staff Analysis and Recommendation

Staff has reviewed the ADM application; the following are the results of staff's review:

- Staff has replicated, using the CA-GREET spreadsheet, the carbon intensity values calculated by ADM for each of the eight sub-pathways;
- ADM has provided documentation for the plant's energy use and ethanol production;
- Staff is satisfied that the energy value in the application accurately represent the plant's energy value;
- Staff is satisfied that the electricity use value in the application accurately represents the plant's electricity use value;
- Future electrical energy and total energy use for the plant will have to be periodically reported to the ARB in order to verify that the electrical and total energy values for the plant in the application are correct.

On the basis of these findings, and subject to the conditions in Table 1, staff recommends that ADM's application for eight Method 2B corn ethanol sub-pathways be approved.

The pathway document posted along with this summary does not include information the applicant considers to be confidential business information. All redactions are noted in the text of that document.